

The Montreal Cognitive Assessment 7.2 – Polish adaptation and research on equivalency

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Summary

Aim. The Montreal Cognitive Assessment is a screening test for diagnosis of Mild Cognitive Impairment- MCI. Only one version of the method was available in Poland so far. In order to assess progression of cognitive impairment, or to diagnose effectiveness of therapy, two equivalent version of method are needed. English additional version 7.2 was translated and culturally adapted to sustain reliability of the assessment. Then equivalency of both Polish versions was investigated. This paper examines whether both polish versions of MoCA are equivalent, and describes the process of its cultural adaptation.

Methods. 66 psychiatric patients (37 men, 29 women) with different levels of cognitive impairment were examined using both polish versions of MoCA. Both versions were administered randomly to patients with no time interval in between.

Results. No significant differences ($p=0.601$) for total MoCA scores were found between first version of Polish MoCA, and alternate version. Equivalency measured by correlation coefficient Spearman's rho correlation coefficient ($\rho=0.926$) proved to be high.

Conclusion. Both Polish versions of MoCA are equivalent, and can be useful in repeated measurement of progress in cognitive impairment or in testing of the effectiveness of treatment.

Key words: Alzheimer's disease, mild cognitive impairment, neuropsychological diagnosis

Introduction

The Montreal Cognitive Assessment (MoCA) was designed by Z. Nasreddine as a screening tool to detect cognitive impairment (Mild Cognitive Impairment – MCI). The tool is designed to assess cognitive functions such as: short-term memory, visual-

spatial functions, executive functions, language functions, verbal fluency, attention, naming, abstraction, and allopsychic orientation. The visual-spatial functions and executive functions are measured by doing three consecutive tasks. The first one is a simplified test that involves connecting dots, inspired by the commonly used Trail Making Test (TMT B). The subject is then instructed to copy a three-dimensional figure, and the figures are varied, depending on the version of the test. The third of the tasks is the clock drawing test (CDT), which involves drawing a clock face, writing successive hours and setting the hands of the clock so that they indicate a specific hour (depending on the version). Naming ability is tested by asking the subject to name three animals that are shown in the illustrations on the test sheet. Following this part of the test, the subject is instructed to repeat a series of five words listed by the researcher. This test is repeated twice, after that the subjects are informed that they will be asked to repeat these words in a few minutes. This part of the task is not to be assessed; its purpose is to master the verbal test material needed to reproduce after postponement. Even before the task associated with deferred remembering, the subject performs subtests within the domains: attention, language, and abstraction. Attention is measured by a subtest involving immediate reconstitution of a series of 5 digits straight, then 3 digits backwards. The selectivity of attention is then tested, the subject is asked to read a sequence of characters (rate: 1 character/1 sec.) and clap whenever the sound “a” appears. Then the subject is asked to sequentially subtract 7 from a specified number. Language skills are tested by exact repetition of two sentences and by exploring their phonemic verbal fluency (different letters in different versions of the test). The subtest checking the abstraction ability involves creating overarching concepts for the two selected topics. The last tasks of the test procedure involve deferred remembering and questions to assess allopsychic orientation. The subject is asked to recall the five previously remembered words. Only words reproduced without hints are awarded points. Categorical hints are given for words not recalled spontaneously, and then materials are given to allow identification of a specific word. Questions testing orientation relate to the exact date, day of the week and the place and town of current residence. The whole MoCA test procedure is expected to take approximately 10 minutes. After proper drawing of first three subtests (trail making test, figure and clock) 5 points are allocated. One point is given for every correct response in Naming subtest, and the subject can be given 3 points. One point is allocated for each correct repetition of digits sequence. Correct reaction for Clapping subtest is rewarded with 2 points, while responses in Serial 7s are scored out of 3 points. For correct repetition of 2 sentences, 2 points are allocated. If more than 11 words are generated by the subject in Fluency subtest, 1 point is allocated; correct answers in Abstraction subtest result with further 2 points. 1 point is allocated for correct recall of each of 5 words in Memory subtest, with possible maximum of 5 points. Each of 6 elements of Orientation subtest is also rewarded with 1 point, with maximum of 6 points. Total score available in MoCA test is 30 raw points.

Validation studies of the MoCA scale in English [1] indicate the method’s promising sensitivity and specificity in detecting mild cognitive impairment at the beginning of Alzheimer’s disease (sensitivity: 90%, specificity: 87%), showing a significant ad-

vantage of the MoCA scale over the commonly used Mini Mental State Examination (respectively: 18% and 100%). Other studies have demonstrated the usefulness of the MoCA scale as a tool for screening vascular cognitive impairment, cerebral metastases, brain tumors, Huntington's disease, psychiatric disorders or Parkinson's disease [2–7]. In Canada, MoCA is currently the method recommended by the National Institutes of Health, the Canadian Stroke Consortium, and The Canadian Consensus Guidelines for Diagnosis and Treatment of Dementia. There are about 35 language versions of this method with different status of validation studies. Beside the above-mentioned advantages, an important strength of this method is that it is free and can be applied cheaply. It can be expected that the Montreal Cognitive Assessment will soon be one of the most widely used and most thoroughly transculturally tested screening methods. In the original English version, a score lower than 26 points (out of a possible 30) is interpreted as indicating the presence of mild cognitive impairment. First version available in Poland, developed in the Department of Old Age Psychiatry and Psychotic Disorders, Medical University of Lodz, the most reliable points in diagnostics for mild cognitive impairment and dementia were respectively 24 and 19 points [8]. All language versions of MoCA are available at www.mocatest.org.

The initial experience with the application of MoCA and the need for monitoring of cognitive function in individual patients using repeated measurements, lead the Mazovian Specialized Health Centre (Tworowski Hospital) to attempt to adapt the second version of MoCA and test both versions for equivalence. Two equivalent versions of the same test allow repeated measurements in individual patients and achieve results not affected by distortion resulting from the priming effect associated with the application of the same test material. After agreeing with the authors of original versions, it was decided to adapt the English equivalent version 7.2.

Material and method

Adaptation work on the Polish equivalent version is planned in three stages: (1) translation of the English version of MoCA 7.2 into Polish, (2) changes associated with the removal of inconsistencies arising from cultural differences, which may have a potential impact on the difficulty of test tasks, (3) reverse translation of the test sheet and instructions and their verification by the authors of the original version. The trail making test preserves the layout of the original version, and the “begin-end” designations were replaced with Polish “początek-koniec” counterparts. There have been changes in the task consisting in copying a three-dimensional figure. The original version of the task (“Copy rectangle”) in the Polish cultural circle suggests a plane figure – rectangle, which can be confusing to the subject and cause them to fail the task. Whereas the task “Copy cuboid” could potentially be too complicated, especially for respondents with fewer years of formal education. In addition, one of the objectives of the adaptation was to maximize the similarity to the Polish version previously published by the team in Lodz, so it has been decided to place the command “Copy shape” in the sheet. The Clock Drawing Test has been translated without changes that would require comments. In the Naming subtest, the original graphics from the English

version 7.2 were left. A number of changes were introduced in the Memory Subtest, since a direct translation of the memory material from the original version raised doubts as to the possible excessive difficulties in completing subtest by respondents. Out of the original five words (truck – banana – violin – desk – green) four were changed. Unlike the authors of the first adaptation of the Polish version, apart from semantic similarities, attention has also been paid to the benefits of phonematic similarity to the version 7.2 due to the use of the phonological loop by test subjects in repetitions of the test material. We were guided by the following principles: (1) test material is to be composed of words with average occurrence popularity in natural language, (2) words used in the test material should have the same or similar number of syllables, (3) these words should, as far as possible, belong to similar semantic categories as in English and (4) they should be similar to the original version in terms of phonetics. In an attempt to reconcile the terms of these criteria, the following set of words has been established: tap – pineapple – violin – table – white.

Table 1. Comparison of original version and adaptation of Memory subtest

Original version	Polish version 7.2	Polish fonetic transcription	Back translation
Truck	Kran	[krãn]	Tap
Banana	Ananas	[ã'nãnas]	Pineapple
Violin	Skrzypce	['skɹɹpt͡ʂɛ]	Violin
Desk	Stół	[stuw]	Table
Green	Biały	['bʲjaw ɨ]	White

In connection with the above-mentioned changes, modifications were introduced to hint categories and words which constitute the material for recognition in the case of a failed deferred memory test. Changes were made in the test instructions. They are presented in the table below.

Table 2. Changes in test instructions – categories of cues

Polish version 7.2	Polish categories of cues	Back translation	Polish multiple choice cues	Back translation
kran	armatura sanitarna	type of bathroom fixture	kran, zlew, rura	tap, sink, pipe
ananas	rodzaj owocu	type of fruit	jabłko, ananas, gruszka	apple pineapple pear
skrzypce	rodzaj instrumentu muzycznego	type of musical instrument	skrzypce, gitara, harmonijka	violin guitar harp

stół	rodzaj mebla	type of furniture	krzesło, stół, łóżko	chair table bed
biały	kolor	a colour	zielony, żółty biały	green yellow white

In the Attention subtest the test material has not been changed, both in straight digits, backwards digits, as well as series of letters and subtraction of sevens. In the Language subtest, the original sentences (1. A bird can fly into closed windows when it's dark and windy; 2. The caring grandmother sent groceries over a week ago) were translated as follows:

1. Gdy jest ciemno i wietrznie, ptak może się rozbić o zamknięte okna;
2. Troskliwa babcia wysłała produkty spożywcze ponad tydzień temu.

As a result of reverse translation, 3 possible versions of the first sentence and 2 versions of the second sentence were obtained. In both cases, these included the original English wording. In a verbal phonemic fluency test, the letter “s” was left as a stimulus to update words. This was guided by the prevalent use of the F-A-S standard in fluency tests throughout the world, as well as the fact that reference was made to it in the Polish adaptation of the first version (it uses the letter F) [9]. The Abstraction and Orientation subtests were left without changes that would require a comment. Reverse translation showed a satisfactory reliability of adaptation and it has been approved by the authors of the original version.

Following the publication of the method (www.mocatest.org) the issue of equivalence of the available Polish versions of the scale was raised. In order to determine whether the new Polish version 7.2 and the first available version of the method are equivalent, a study, involving 66 patients of the Department of Psychiatry, Medical University of Warsaw, was performed. The test subjects included 37 men and 29 women (56% and 43%, respectively) aged 18-75 years. The group of patients included people with different levels of cognitive functioning. The sample group included patients with cognitive dysfunctions with organic background and patients with cognitive impairment due to diseases and mental disorders, as well as individuals without any mental or cognitive disorders. Diagnoses were based on interviews, observation and the use of other standard diagnostic methods used in the clinic (Trail Making Test, Benton Visual Retention Test, Rey 15-Item Memory Test, Mini Mental State Examination, Pictogram, SCID-II, MMPI-2, computed tomography, electroencephalography). The subjects were tested with two versions of the MoCA scale. The study in each case was carried out without a gap between the versions, and the order of application of the different versions of the method was random.

The minimum size of the research group has been set to 50 people, based on the argument that to ensure the calculated significance of the correlation coefficient is resistant to errors even despite the lack of fulfilment of assumptions of normality and

homogeneity of variance decomposition requires a sample composed of at least 50 observations [10].

Results

The overall results of the first test version of the MoCA ranged from 6 to 30 raw points, and the results of the newly created version 7.2 ranged from 5 to 30 points.

The equivalence of the MoCA version adapted by a team in Lodz and the version adapted by the team at the Department of Medical University of Warsaw has been checked by calculating the coefficient of the inter-equivalence, i.e. the correlation coefficient between the overall results of both versions. In this case, it was decided to use the Spearman's rank correlation coefficient.

Table 3. Inter-test equivalency coefficient Spearman's Rho (N = 67)

		MoCA II
Spearman's Rho	MoCA I	0.926**

** – two-tailed significance 0.01

In addition to specifying the level of covariance results, it was decided to determine whether there are significant differences in the average performance between the two versions of the MoCA. For this purpose, the Wilcoxon signed-ranks test was used. The mean of negative ranks was 22.41, and mean of positive ranks was – 21.53.

Table 4. Significance of differences between first version of MoCA and Polish adaptation of version 7.2 (Wilcoxon ranks test)

	MoCA II – MoCA I
Z	-0.523 ^a
Significance (two-tailed)	0.601

a. based on positive ranks

The results of Wilcoxon's test indicate the absence of statistically significant differences between the average results of the two versions of the MoCA. This means that if there were any differences in the overall results in the same patients, they were insignificant and did not result from any systematic trend.

Table 5. Correlations between scores of relevant subtests of MoCA and MoCA 7.2

Visual-spatial	Naming	Attention (digit span)	Attention (clapping)	Attention (serial 7s)	Sentence repetition	Fluency	Abstraction	Memory	Orientation
0.727**	0.590**	0.29	0.33	0.716**	0.497**	0.36	0.510**	0.583**	0.936**

** Significance $p < 0.01$

Kendall tau-b correlation analyses suggest satisfactory covariance of subtests' scores. Correlations between versions of attention (digit span, clapping) and fluency subtest are not significant, these subtests, however, are vulnerable to attention problems, which could be expected in clinical group.

Discussion

Little data has so far been collected on the equivalence of alternative versions within each linguistic adaptation. Canadian research indicates the equivalence of the English and the French versions developed in Canada [1]. The results of studies confirming the equivalence of the three German-language alternative versions were also published, with correlation results particularly strong in the clinical groups. For each version, the pattern of results consistent with the assumptions of the method has also been confirmed: the control group reached significantly higher scores than the group with mild cognitive impairment, and a group with mild cognitive impairment reached higher scores than the group of patients with dementia in Alzheimer's disease. The authors concluded that the above-mentioned conditions demonstrate the equivalence of the three versions so that these versions can be used interchangeably in clinical diagnosis as well as in longitudinal studies [11].

It seems that from the point of view of cultural adaptation of neuropsychological tests [12], some controversy may be raised over the items used in the Naming subtest, depicting a giraffe, a hippo and a bear. It can easily be noted that two of the three animals are not species naturally occurring in Poland. It also appears, however, that the assumptions of Canadian authors focused on creating of task somewhat more difficult than allowing the detection of dementia. As in the case of Canadian English-language version, the test material included illustrations of 1 animal within a close cultural circle and 2 animals living naturally in other continents.

It is also worth mentioning the limitations of this study. It cannot provide a basis for determining the positive and negative predictive power of the new version of the test and the cut-off point for mild cognitive impairment (MCI) and Alzheimer's dementia (AD). Therefore, further studies are needed for people with MCI and AD, which would allow the determination of these parameters, which would show an application value of the method and allow the determination of clinical equivalence of both versions of the scale.

Notwithstanding the above restrictions, studies have shown that in patients with different levels of cognitive functioning, the overall results of both Polish versions of MoCA do not differ beyond the limits of statistical error. The potential of this method shows that they may be equivalent in the clinical aspect.

Conclusions

1. The Montreal Cognitive Assessment version 7.2 is a potentially useful tool in the screening diagnosis of cognitive disorders.

2. The overall results of the Polish adaptation of MoCA and the Polish adaptation of MoCA 7.2 show a very high covariation, and their mean ranks in the group of patients with different levels of cognitive functioning do not differ significantly from each other.
3. Further studies should focus on determining the cut-off points for MCI and dementia against MoCA 7.2, determining their positive and negative predictive power and comparing these parameters with the parameters of the version developed by a team Lodz. Confirmation of the clinical equivalence of the two versions would significantly expand the application value of the scale, allowing clinicians to perform longitudinal studies, repeated measurements in research and track the status of cognitive function in individual patients.

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Statement

The Authors declare no conflict of interest.

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